Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A gas mixture temperature estimation method for an internal combustion, the method comprising:

estimating a temperature of a gas mixture produced through mixing of fuel injected into a combustion chamber of the internal combustion engine and a cylinder interior gas, which is a gas having been taken into the combustion chamber, ~~under the assumption that~~ wherein:

when the gas mixture does not stagnate, a heat transfer does not occur between the gas mixture and an object or substance existing around the gas mixture and the temperature of the gas mixture is calculated based on a quantity of a heat of the fuel injected into the combustion chamber and a quantity of a heat of the cylinder interior gas, and

when the gas mixture stagnates in a generally annular configuration in the vicinity of a side wall of the combustion chamber, ~~and~~ the heat transfer occurs between the gas mixture and ~~an~~ the object or substance existing around the gas mixture during a period in which the gas mixture stagnates and the temperature of the gas mixture is calculated based on the quantity of the heat of the fuel injected into the combustion chamber, the quantity of the heat of the cylinder interior gas, and a quantity of a heat transferred between the gas mixture and the object or substance existing around the gas mixture.

2. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 1, wherein the temperature of the gas mixture is estimated ~~under the assumption that~~ when the stagnation of the gas mixture occurs after the gas mixture reaches an inner wall surface of the combustion chamber.

3. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 1, wherein the object or substance existing around the gas mixture comprises the wall of the combustion chamber in contact with the gas mixture and the cylinder interior gas in contact with the gas mixture.

4. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 2, wherein the object or substance existing around the gas mixture comprises the wall of the combustion chamber in contact with the gas mixture and the cylinder interior gas in contact with the gas mixture.

5. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 3, wherein the quantity of heat transferred between the gas mixture and the wall of the combustion chamber is calculated on the basis of an area of contact and a thermal conductivity between the gas mixture and the wall of the combustion chamber; and the quantity of heat transferred between the gas mixture and the cylinder interior gas is calculated on the basis of an area of contact and a thermal conductivity between the gas mixture and the cylinder interior gas.

6. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 4, wherein the quantity of heat transferred between the gas mixture and the wall of the combustion chamber is calculated on the basis of an area of contact and a thermal conductivity between the gas mixture and the wall of the combustion chamber; and the quantity of heat transferred between the gas mixture and the cylinder interior gas is calculated on the basis of an area of contact and a thermal conductivity between the gas mixture and the cylinder interior gas.

7. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 5, wherein the thermal conductivity between the gas mixture and the wall of the combustion chamber and the thermal

conductivity between the gas mixture and the cylinder interior gas are individually changed in accordance with pressure of the cylinder interior gas.

8. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 6, wherein the thermal conductivity between the gas mixture and the wall of the combustion chamber and the thermal conductivity between the gas mixture and the cylinder interior gas are individually changed in accordance with pressure of the cylinder interior gas.

9. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 5, wherein the thermal conductivity between the gas mixture and the wall of the combustion chamber is changed in accordance with a value representing the speed of a flow of the gas mixture generated by a swirl.

10. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 6, wherein the thermal conductivity between the gas mixture and the wall of the combustion chamber is changed in accordance with a value representing the speed of a flow of the gas mixture generated by a swirl.

11. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 7, wherein the thermal conductivity between the gas mixture and the wall of the combustion chamber is changed in accordance with a value representing the speed of a flow of the gas mixture generated by a swirl.

12. (Currently Amended) ~~A~~The gas mixture temperature estimation method for an internal combustion engine according to claim 8, wherein the thermal conductivity between the gas mixture and the wall of the combustion chamber is changed in accordance with a value representing the speed of a flow of the gas mixture generated by a swirl.

13. (New) The gas mixture temperature estimation method for an internal combustion engine according to claim 2, wherein an increasing quantity of the cylinder interior gas is mixed with the fuel over time.

14. (New) The gas mixture temperature estimation method for an internal combustion engine according to claim 1, further comprising estimating a traveling distance over which the gas mixture travels from an injection opening successively after the injection of fuel.